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EXAMINER	
SMITH, JACKSON R	
ART UNIT	**PAPER NUMBER**
1709	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/790,759	Applicant(s) MARUYAMA, EIJI	
	Examiner Jack Smith	Art Unit 1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 - 20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/3/04*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

8DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 – 7 and 15 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue et al. (US Patent 5,344,498) in view of Neerinck et al. (D.G. Neerinck and T.J. Vink, Thin Solid Films 278 (1996) 12-17).

As to claim 1, Inoue et al. teaches a photovoltaic device (a-Si solar cell element, 100, Figure 1) comprising: a photoelectric conversion layer (a-Si semiconductor layer, 103; Column 7, lines 22 - 26) receiving light incident from the front surface side (i.e., incident on the side of the element bounded by 104); and a transparent conductive film (transparent conductive layer, 104), formed on the front surface of said photoelectric conversion layer, wherein the transparent conductive layer is indium oxide (indium tin oxide, ITO, Column 8, lines 6 – 11). Inoue fails to provide is an explicit disclosure of indium oxide layers having (222) plane orientation with two (222) peaks in said indium oxide layer.

Neerinck et al. disclose an indium tin oxide film suitable for use in optoelectronic applications as a transparent conductor (Introduction, 1st paragraph). As shown in Figure 1, this film has a (222) plane orientation with two (222) peaks ("doublet-type peak profile," figure caption) in its x-ray diffraction

spectrum. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the ITO films taught by Neerick et al. as the transparent conductor in the device of Inoue et al. in order to provide low resistivity and high transmissivity to visible light in the electrode (Introduction, 1st paragraph). Further, Inoue et al. suggests using ITO deposited using the general methods, sputtering, used by Neerinck et al.

As to claim 2, the photovoltaic device of Inoue et al. comprises a semiconductor layer (a-Si semiconductor layer, 103; Column 7, lines 22 - 26), formed on said transparent conductive film, that consists of an amorphous semiconductor (i.e., amorphous silicon).

As to claim 3, said (222) peaks in Figure 1 of Neerinck et al. for the indium tin oxide transparent conductor include: a first peak having an X-ray diffraction angle, 2θ, of about 30.1 ± 0.1 degrees, and a second peak having an X-ray diffraction angle, 2θ, of about 30.6 ± 0.1 degrees.

As to claim 4, the ratio (I1/I2) of the intensity of said first peak ($I1 \approx 2.5$, in arbitrary units, according to Figure 1 of Neerinck et al.) to the intensity of said second peak ($I2 \approx 5.5$, in arbitrary units, according to Figure 1) is approximately 0.46.

As to claim 5, the ratio (I1/I2) of the intensity of said first peak ($I1 \approx 2.5$, in arbitrary units, according to Figure 1 of Neerinck et al.) to the intensity of said second peak ($I2 \approx 5.5$, in arbitrary units, according to Figure 1) is approximately 0.46.

As to claim 6, the indium oxide layer of Neerinck et al., as an indium tin oxide layer (ITO), contains Sn.

As to claim 7, the composition of the target used in the sputter deposition of the indium tin oxide layer of Neerinck et al. was 90 wt. % In_2O_3 and 10 wt. % SnO_2 (Experimental section, 1st paragraph) implying that the content of Sn in the indium tin oxide layer was between 1 – 10 wt. % with respect to In.

As to claim 15, the photovoltaic device (a-Si solar cell element, 100, Figure 1) of Inoue et al. is a device that has a transparent conductive film (transparent conductive layer, 104) and comprises: a substrate (substrate, 101); and a transparent conductive film (transparent conductive layer, 104), formed on said substrate. While the transparent conductive layer disclosed by Inoue et al. is generic, it suggests an indium oxide layer (indium tin oxide, ITO) as the transparent conductive layer in Column 8, lines 6 – 11. Inoue fails to provide is an explicit disclosure of indium oxide layers having (222) plane orientation with two (222) peaks in said indium oxide layer.

Neerinck et al. disclose an indium tin oxide film suitable for use in optoelectronic applications as a transparent conductor (Introduction, 1st paragraph). As shown in Figure 1, this film has a (222) plane orientation with two (222) peaks ("doublet-type peak profile," figure caption) in its x-ray diffraction spectrum. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the ITO films taught by Neerick et al. as the transparent conductor in the device of Inoue et al. in order to provide low resistivity and high transmissivity to visible light in the electrode (Introduction, 1st

paragraph). Further, Inoue et al. suggests using ITO deposited using the general methods, sputtering, used by Neerinck et al.

As to claim 16, said (222) peaks of said indium tin oxide transparent conductor of Neerinck et al. include: a first peak having an X-ray diffraction angle, 2θ, of about 30.1 ± 0.1 degrees, and a second peak having an X-ray diffraction angle, 2θ, of about 30.6 ± 0.1 degrees (Figure 1).

As to claim 17, the indium oxide layer of Neerinck et al., as an indium tin oxide layer (ITO), contains Sn.

As to claim 18, the composition of the target used in the sputter deposition of said indium tin oxide layer of Neerinck et al. was 90 wt. % In_2O_3 and 10 wt. % SnO_2 (Experimental section, 1st paragraph) implying that the content of Sn in the indium tin oxide layer was between 1 – 10 wt. % with respect to In.

3. Claims 8 – 14, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura et al. (US Patent 7,030,413 B2) in view of Vink et al. (T.J. Vink, W. Walrave, J.L.C. Daams, P.C. Baarslag, J.E.A.M. van den Meerakker, Thin Solid Films 266 (1995) 145-151).

As to claim 8, Nakamura et al. discloses a photovoltaic device (photovoltaic device, Figure 1) comprising: a first conductivity type crystalline semiconductor substrate (n-type single crystalline Si, 11) having a front surface and a back surface and receiving light incident from the side of said front surface; a substantially intrinsic first amorphous semiconductor layer (the layer formed by the combination of intrinsic amorphous SiC and Si, layers 13 and 14) formed on said front surface of said crystalline semiconductor substrate; a second

conductivity type second amorphous semiconductor layer (p-type amorphous Si, 14) formed on said first amorphous semiconductor layer; and a transparent conductive film (transparent electrode, 15), formed on said second amorphous semiconductor layer. Nakamura teaches that the transparent conductive film is an indium oxide layer (indium tin oxide, Column 4, lines 34-35). What Nakamura fails to provide is an indium oxide layer having (222) plane orientation with two (222) peaks in said indium oxide layer.

Vink et al. disclose an indium tin oxide film suitable for use in optoelectronic applications as a transparent conductor (Introduction, 1st paragraph). The x-ray diffraction pattern of one such film, i.e., a film that is annealed and sputter-deposited at room temperature according to the teachings of Vink et al., appears in Figure 1 of Neernick et al. As shown in Figure 1, this film has a (222) plane orientation with two (222) peaks ("doublet-type peak profile," figure caption) in its x-ray diffraction spectrum. Further, Vink et al. report results showing that annealed, tin oxide films sputter deposited at room temperature on tin oxide films have low intrinsic stress (Conclusion paragraph, 2nd to last sentence). Vink et al. further disclose that the use of indium tin oxide films with low internal stress is advantageous to prevent deformation and fracture (Introduction, 1st paragraph). The indium oxide film of Nakamura et al. was sputter deposited at a substrate temperature of 180°C, well over 100°C in excess of room temperature, which would leave it prone to internal stress. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to replace the transparent conductive film in Nakamura et al. by a film

sputter deposited at room temperature and annealed according to the teachings of Vink et al. in order to prevent deformation and fracture.

As to claim 9, said (222) peaks in Figure 1 of Neerinck et al. include: a first peak having an X-ray diffraction angle, 2θ, of about 30.1 ± 0.1 degrees, and a second peak having an X-ray diffraction angle, 2θ, of about 30.6 ± 0.1 degrees.

As to claim 10, the ratio (I1/I2) of the intensity of said first peak (I1 ≈ 2.5, in arbitrary units, according to Figure 1 of Neernick et al.) to the intensity of said second peak (I2 ≈ 5.5, in arbitrary units, according to Figure 1) is approximately 0.46.

As to claim 11, the ratio (I1/I2) of the intensity of said first peak (I1 ≈ 2.5, in arbitrary units, according to Figure 1 of Neernick et al.) to the intensity of said second peak (I2 ≈ 5.5, in arbitrary units, according to Figure 1) is approximately 0.46.

As to claim 12, said indium oxide layer of Neerinck et al., as an indium tin oxide layer (ITO), contains Sn.

As to claim 13, the composition of the target used in the sputter deposition of said indium tin oxide layer of Neerinck et al. was 90 wt. % In_2O_3 and 10 wt. % SnO_2 (Experimental section, 1st paragraph) implying that the content of Sn in the indium tin oxide layer was between 1 – 10 wt. % with respect to In.

As to claim 14, in the photovoltaic device of Nakamura et al. (photovoltaic device, Figure 1), said crystalline semiconductor substrate (n-type single crystalline Si, 11) is an n-type semiconductor substrate, and said second

amorphous semiconductor layer is a p-type semiconductor layer (p-type amorphous Si, 14).

As to claim 19, in the photovoltaic device of Nakamura et al. (photovoltaic device, Figure 1), the first conductivity type single-crystalline silicon substrate (n-type single crystalline Si, 11) has a front surface and a back surface and receiving light on the side of said front surface; a substantially intrinsic first amorphous silicon layer formed on said front surface of said single- crystalline silicon substrate (the layer formed by the combination of intrinsic amorphous SiC and Si, layers 13 and 14); a second conductivity type second amorphous silicon layer formed on said first amorphous silicon layer (p-type amorphous Si, 14); and a transparent conductive film, formed on said second amorphous silicon layer, including an indium oxide (indium tin oxide, Column 4, lines 34-35). What Nakamura fails to provide is an indium oxide layer having (222) plane orientation with two (222) peaks in said indium oxide layer.

Vink et al. disclose an indium tin oxide film suitable for use in optoelectronic applications as a transparent conductor (Introduction, 1st paragraph). The x-ray diffraction pattern of an example of one film sputter deposited at room temperature and annealed according to the teachings of Vink et al.. appears in Figure 1 of Neerinck et al.. As shown in Figure 1, this film has a (222) plane orientation with two (222) peaks ("doublet-type peak profile," figure caption) in its x-ray diffraction spectrum. Further, Vink et al. report results showing that annealed, tin oxide films sputter deposited at room temperature on tin oxide films have low intrinsic stress (Conclusion paragraph, 2nd to last

sentence). Vink et al. further disclose that the use of indium tin oxide films with low internal stress is advantageous to prevent deformation and fracture (Introduction, 1^{st} paragraph). The indium oxide film of Nakamura et al. was sputter deposited at a substrate temperature of 180°C, well over 100°C in excess of room temperature, which would leave it prone to internal stress. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to replace the transparent conductive film in Nakamura et al. by a film sputter deposited at room temperature and annealed according to the teachings of Vink et al. in order to prevent deformation and fracture.

As to claim 20, said (222) peaks in Figure 1 of Neerinck et al. include:: a first peak having an X-ray diffraction angle, 2θ, of about 30.1 ± 0.1 degrees, and a second peak having an X-ray diffraction angle, 2θ, of about 30.6 ± 0.1 degrees.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack Smith whose telephone number is (571) 272-9814. The examiner can normally be reached on 7:30 a.m. - 5:00 p.m., Mon - Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information

for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JRS

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